FLORA W. PATTERSON
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DISEASES OF TOMATOES

Mel. T. Cook & W. H. Martin

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DISEASES OF TOMATOES[1]

Tomato growing is one of the very important agricultural industries in New Jersey. Tomatoes are grown extensively for general market purposes and for the canneries. Like all other farm crops, the tomato is subject to many diseases which reduce the yield and profits. These diseases are the subject of so many inquiries being sent to the Agricultural Experiment Station that we have decided to issue this circular for the information of the growers.

Fig. 1.—First stage of leaf blight. Note the lower leaves. (Photo by R. W. DeBaun.)

LEAF BLIGHT, LATE BLIGHT (*Septoria lycopersici* Speg.)

This very widely distributed fungus is the cause of greater losses in New Jersey than any other disease of the tomato. It first appears in the extreme southern part of the state, early in July, and at points farther north a little later. It first appears on the lower leaves as small, dark, angular or circular spots, the centers somewhat lighter in color than the borders. The spots increase in

[1]Prepared April 25, 1917, by Mel. T. Cook, Ph. D., Plant Pathologist, and W. H. Martin, A. B., Assistant Plant Pathologist, New Jersey Agricultural Experiment Station.

size until about 1/8 inch in diameter, the leaves turn yellow, curl, dry and fall. It also attacks the stems, causing more or less elongated spots. It is found also on the green fruit, but is not conspicuous. The disease always starts with the lower leaves and gradually travels up the plant until later in the season we find long stems with bunches of leaves and fruits near the tip. The destruction of the foliage causes a reduced yield; exposes the fruit to sunburn, and usually results in early ripening (page 6).

This disease can be held in check by thorough spraying with Bordeaux mixture.

Early Blight and Fruit Rot (*Macrosporium solani* E & M).

This fungous disease attacks both tomatoes and potatoes. Although called the "early blight", it appears at about the same time as the late blight. It appears as small, black angular spots which increase in size until they are quite large and frequently show concentric rings. It also attacks the fruit, causing small, black spots. It is one of the minor diseases in this state.

It can be controlled by thorough spraying with Bordeaux mixture.

Late Blight [*Phytophthora infestans* (Mont.) DeBary]

This fungous disease of the foliage and occasionally of the fruit also attacks potatoes. It is of little or no importance in New Jersey, and can be controlled by thorough spraying with Bordeaux mixture.

Fig. 2.—Anthracnose, or ripe rot.

Anthracnose or Ripe Rot [*Colletotrichum phomoides* (Sacc.) Chester]

This fungous disease attacks the ripe and nearly ripe fruit causing a soft, rapid decay. The spots may start on any part of the fruit. They are circular, and at first have the appearance of being water-soaked but finally become black. They frequently unite and cause irregular rotten areas. It is especially severe on

sun-burnt plants that have been defoliated by the leaf blight (page 2) and other causes. The losses due to this disease are very heavy and second in importance only to the leaf blight.

This disease can be controlled by thorough spraying with Bordeaux mixture.

LEAF AND FRUIT SPOT (*Phoma destructiva* Plow)

This is a fungous disease of both leaf and fruit which has not been reported from this state. It starts on the lower leaves, causing brown or black irregular spots which frequently unite. It causes large black spots on both green and ripe fruit but, so far as we know, cannot attack fruits which have not been injured in some way.

LEAF MOLD (*Cladosporium fulvum* Cke.)

This is a fungous disease of the foliage which causes little or no trouble in the New Jersey field crops but is occasionally reported as the cause of losses in greenhouses. It appears as whitish or grayish-brown patches, which spread over the surface of the leaves, causing them to die and curl up. It also attacks the fruit, frequently causing a "blossom end rot".

It can be held in check to some extent by Bordeaux mixture, but cannot be controlled.

BLOSSOM END OR POINT ROT

There has been and still is, considerable difference of opinion as to the cause of this disease. The writer is inclined to believe that it may be due to any one of several causes, but that it is most frequently due to soil and moisture conditions. In most cases that have come to our attention, we have been inclined to accept the view of other workers who have conducted experiments with this disease and who believe that it is favored by lack of moisture. However, we have demonstrated that the fungus *Botrytis* may be a cause. There is also evidence that other organisms (*Fusarium, Macrosporium, Cladosporium* and bacteria) may be the cause of the disease under some conditions.

This disease starts at the point, or blossom end, and causes large, black, sunken, soft rot spots. It is fully as prevalent on the green as on the ripe fruits.

Good soil and thorough cultivation are the only recommendations that can be made at this time.

MINOR LEAF AND FRUIT DISEASES

There are several other fungous diseases of minor importance attacking both foliage and fruit, which will not be considered at this time. Most of them can be held in check by thorough spraying with Bordeaux mixture.

WILT OR SLEEPING SICKNESS (*Fusarium lycopersici* Sacc.)

This disease is due to a fungus which lives within the stem of the plant and causes a wilting and slow dying of the plant. On cutting the stems with a sharp knife, discolored tissue will be found just below the bark. Plants are frequently affected with this disease from the seed-bed; but are usually well advanced before they begin to die. Death usually results long before the plant has produced a full crop. This disease is very destructive in parts of New Jersey.

The fact that the organism lives within the plant makes it impossible to control the disease by spraying. Seed-beds should always be made from clean soil which has not been used for the growing of tomatoes for some time. If it is known that the disease has been in the seed-bed the previous year; all the soil should be removed and the wood-work thoroughly drenched with copper sulfate solution (2 pounds of copper sulfate in 50 gallons of water) before the new soil is put in. Do not put tomatoes in a field in which the disease has occurred without using a rotation of crops.

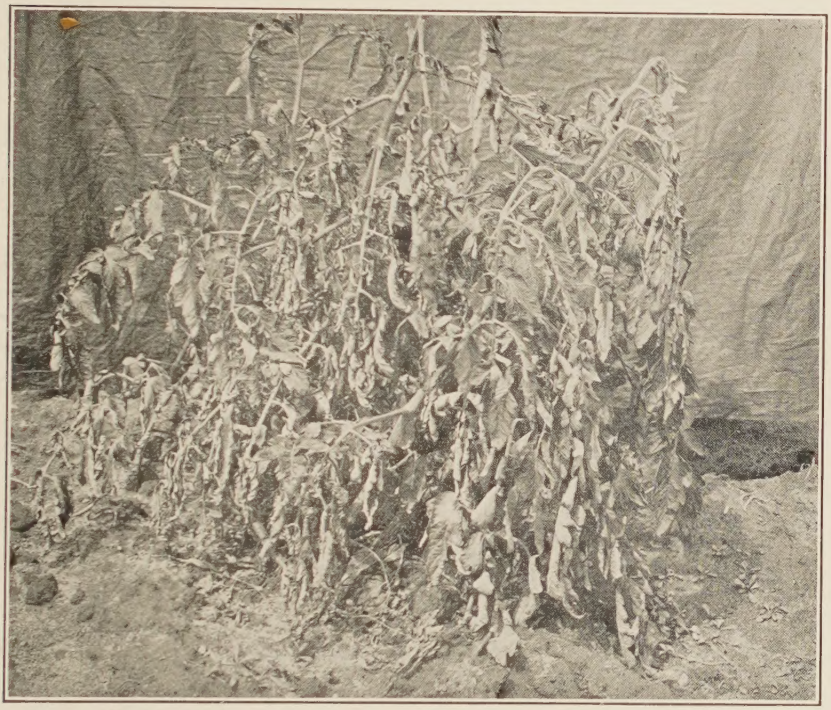

Fig. 3.—Wilt. (Photo by R. W. DeBaun.)

Another WILT OR SLEEPING SICKNESS due to bacteria (*Bacterium solanacearum* Sm.) occasionally appears in the southern part of the state. It can be recognized by the fact that the plants wilt during the day and revive during the night for two or three days and then die. It is of comparatively little importance in New Jersey.

ROOT ROTS are usually due to fungi and can be kept in control by the use of clean seed-beds and rotation of crops.

MOSAIC AND FILIFORM (cause unknown)

This disease was very prevalent in New Jersey in 1915 and in 1916, and no doubt contributed to reducing the crop. The mild forms of the disease appear as a peculiar mottling of the leaves, ranging from light green to yellow blotches. This is frequently followed by a dying of parts of the leaves and stems. This mottling is frequently accompanied by a rolling of the leaves. In more severe cases we find a dwarfing of the leaf due to a notching which gives the general appearance of a fern leaf. In some cases the

blade of the leaf is reduced to such an extent that there is very little remaining, other than the mid-rib and larger veins. In the most advanced cases, the plants are dwarfed and produce little or no fruit. Large, slightly affected plants will probably produce as much fruit as the healthy or normal plants.

This same, or a very similar disease, occurs on peppers, tobacco and many other plants. It is similar to but apparently different from the mosaic of the potato. There is no satisfactory method of control, but it is well known that it can be transmitted from plant to plant, and that it is frequently spread in greenhouse plantings in this manner. It is probably spread in the field by farm implements and by insects. Studies at the New Jersey Agricultural Experiment Station indicate that it will persist from year to year in the greenhouse soil.

Fig. 4.—Mosaic and filiform.

SHEDDING OF BLOSSOMS. This is frequently the cause of a partial or complete loss of the crop. It may be due to any one of several causes, such as excess of nitrogen fertilizer or unfavorable weather conditions.

SUN BURN of the fruit is increased by the loss of foliage due to leaf blight and other foliage diseases. It not only injures the fruit, but also makes it more susceptible to the fruit rots (pages 2 and 3).

DAMPING-OFF is primarily a seed-bed disease, but sometimes attacks larger plants, especially those grown under glass. It may be due to any one of several soil fungi. These organisms thrive in manures and are frequently introduced into the seed-beds through the application of manure. They attack the young plants at the surface of the soil, causing them to wilt, fall and die very quickly.

They can be controlled, or even eradicated, by sterilizing the

soil. This can be done in a number of ways, but the most common methods are the use of formaldehyde and of steam.

FORMALDEHYDE STERILIZATION OF THE SOIL

The soil should be moist and well stirred before the application. The solution should be a 4-50 [4 lbs., or pts., of 40 per cent formaldehyde (formalin) to 50 gal. of water]. This should be applied at the rate of 1 gallon to the square foot of soil surface. The solution should be applied slowly in order to insure a thorough saturation and to prevent loss by drainage. Immediately following the application, the soil should be covered with burlap, tarpaulin, old carpet, fertilizer sacks or paper, for about two days. The covering should then be removed and the soil allowed to air thoroughly for ten days or two weeks. During this period the soil

Fig. 5.—Field spraying for leaf blight. (Photos by R. W. DeBaun).

should be frequently stirred thoroughly. If the soil is not aired thoroughly, the seeds may not germinate well.

Caution. Do not add manure after sterilization. Be sure that the work tools are clean. Failure to observe these precautions may result in reinfection of the soil.

STEAM STERILIZATION OF SOIL

The inverted pan method is most satisfactory. The pan may be made of No. 22 galvanized sheet iron, or from pine timber. Both types are satisfactory. The dimensions for outdoor work should be 10 by 6 feet. A 15-horsepower or higher power boiler is desirable. One-inch rubber hose makes the connection between the boiler and a nipple at the center of the pan. The edges of the pan should be pushed down into the loose soil. The soil should be moist but not wet. The application should extend over one hour at about 250°F.

SPRAYING

The following diseases can be held in check but not absolutely controlled by spraying with Bordeaux mixture: leaf or late blight, early blight, anthracnose, and leaf mold. The wilt diseases and mosaic cannot be controlled by spraying with Bordeaux mixture.

In our field experiments[2] in 1916 the best results were obtained by using a 4-4-50 mixture. The first treatment was in the seed-bed and the field treatments were applied about every week or ten days, making a total of six or possibly seven applications.

The seed-bed treatments appeared to be advantageous. However, in spraying seedlings grown under glass it is advisable to use a weak mixture in order to avoid burning the foliage.

It was very evident that our early treatments, given before the appearance of the disease in the field, were of great value.

The fruit from the sprayed plants was of better growth and finer in texture than that from the unsprayed plants.

Fig. 6.—Fruit cracks which are favorable for inoculation by rot organism.

The sprayed plants were vigorous for a longer period than the unsprayed plants.

There was no evidence that the spraying influenced the period of ripening.

The 2-3-50 mixture gave good results. There was no apparent advantage in using mixtures stronger than 4-4-50.

The increased profits from spraying will vary with the cost of labor, cost of copper sulfate, thoroughness of the treatments, weather conditions and selling price of the fruit.

For preparing Bordeaux mixture see Circular 48 of the New Jersey Agricultural Experiment Station.

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[2]These experiments were conducted in cooperation with the U. S. Bureau of Plant Industry and the H. J. Heinz Company, and were under the immediate direction of Mr. W. H. Martin, of the New Jersey Agricultural Experiment Station.